THE TEACHER'S OUTFIT IN PHYSICAL GEOGRAPHY

I.

THE PROPER FIELD OF PHYSICAL GEOGRAPHY

THE teaching of physical geography in the secondary schools is now in a transition stage. There has long been a feeling among teachers and parents that the study of the earth should be carried beyond the elementary course of geography in the lower grades. Naturally enough, therefore, the subject of physical geography has found a place in the high school curriculum in a large number of places. The feeling of dissatisfaction with the ordinary science teaching in the secondary schools, which found such vigorous expression in the report of the Committee of Ten, has been stronger in its relation to physical geography than to any other single subject. This is certainly justified, for the subject has in most cases been thrown into the curriculum mérely because of the demand for it from outside; its position has been insecure; it has been thought that almost any of the teachers in the school could give the instruction in it; and in almost every way, the teaching and the matter taught have been scarcely calculated to raise the subject to a rank equal to that of most which are taught in the secondary schools. Added to this is the fact that the available books have usually been merely a mass of disjointed facts, not only poorly assorted, but very often decidedly inaccurate. The best that can be claimed for the subject in this condition is that it gives a mass of information; and nearly every one has been convinced that even the end of imparting desirable information has hardly been reached by the instruction.

So it has come to pass that physical geography has been omitted from many schools, and has deservedly taken a very insecure position in many others. This, which has lately been

called the old school of physical geography, is little more than descriptive geography. In America, and to a less extent in Europe also, that part of physical geography which deals with the land has of late begun to become a real science, which has been called *physiography* or *physiographic geology*. This new aspect of physical geography recognizes that the land form is something more than mere dead earth features, which are capable of description, and discovers that these forms are merely a part of an ever-changing history. The outlines of the land have developed and are still in process of change; and, when viewed from the proper standpoint, each and every feature of the land has a story to tell.

In strongly urging the introduction of this physiographic study into the curriculum of the secondary school, the subcommittee on geography of the Committee of Ten, has intimated, what is perfectly apparent to all who have thought upon the matter, that one of the difficulties in the way of its introduction, is the fact that most of the present science teachers have no training in physiographic matters. This new aspect of physical geography has only of late found a place in a few of the larger colleges, and until recently there has been no general book in which the subject is treated. Now that there is a text-book adapted to use in the schools, and since there is every reason for believing that the recommendation of the Committee of Ten will be followed, at least in a degree, it seems a fitting time to indicate, in a general way, how the teacher may prepare himself, and what materials are available for use in this class of instruction.

Before commencing this task, I would briefly outline what seems to me best adapted to the needs and conditions of the schools. While I agree most heartily with the spirit of the report of the Committee of Ten, and also with many of its recommendations, I find myself at variance with some of the suggestions. It is the proposition to reduce physical geography to a position intermediate between geography and the more specialized consideration of several aspects of this subject, namely, meteorology,

physiography and geology. While this may do for an ideal scheme, I think that many teachers will see grave obstacles in the way of its adoption. The outfit necessary, both in the materials and the training of teachers, is beyond the reach of the great majority of schools; moreover, the pressing claim for a place in the school course that may be made for the other physical and natural sciences furnishes another obstacle to the introduction of the plan of the committee under the present conditions of education in this country. Besides this, the supporters of the schools, the great public, are bound to be recognized, even if they do interfere with the best ideal educational scheme. At some future time we may find the conditions ripe for the adoption of this plan; but unless I am entirely in error that time has not yet come.

Again, I cannot agree with the idea that physiography is capable of being properly taught separately from geology. It is really and distinctly a branch of geology, and to appreciate its most fundamental conceptions, one must first know something of geology. That this is distinctly so is plainly enough shown by the fact that the ones who have built up physiography have all been geologists, and have done so on the basis of their geological training. Had it not been for trained geologists, we would not yet have had the science of physiographic geology. It does not follow from this that the students must be trained geologists, but it does follow that they must know something of geology. In my own experience in teaching the subject of physiographic geology, I have found it necessary to furnish some geology as a basis on which to build further study; and I have never known a student who has gained a clear idea of the subject without having it built on a geological basis.

I have been thus at length in stating my objections to the plan of the Committee of Ten in order that my reasons for considering the subject as I do may become apparent. For the above reasons, rather than *degrade* physical geography, in order to give a place to physiography and meteorology, I would attempt to *elevate* physical geography by the introduction of

more rational methods, somewhat as the committee has suggested.

Aside from the necessity which I believe to be imposed by the conditions that control the curriculum, there seems to be a very strong reason why physical geography should have an important place in the secondary schools, in the fact that it presents a knowledge of the earth's features as a consecutive and connected whole. The study of the air, the ocean and the land will furnish to the student some knowledge of the earth as a whole. In the way proposed, this knowledge may be imparted without making the gaining of information the single or even the primary goal. Valuable mental discipline may also be given; and if the instruction is good, this result may be made one of high importance. Under the present conditions, it seems to me that both training and information must be recognized as necessary aims in the school, whether this is best from the ideal standpoint or not. In the high school I would not attempt to teach physiography, nor even meteorology, apart from physical geography, unless, indeed, there are some schools which are sufficiently advanced, or which have the necessary teachers for this particular class of science teaching. These subjects may very well be given over to the college at present. Enough of them for the purpose of the secondary school student can be studied as a part of physical geography; and they furnish no training which cannot be as well gained by a rational study of physical geography, and the various other sciences now taught in the schools.

Therefore the course which I would urge is a study of geology in connection with and in its relation to physical geography. If but one year can be given to the subject, I would have first a study of the air, then of the ocean, and this followed by enough geology to serve as a basis for a proper understanding of the physiographic study of the land which then follows. If more time than this can be given, I believe it would be vastly to the advantage of the student, both from the standpoint of mental discipline and of desirable information gained, to elaborate the geological side by a more thorough course in the study of min-

erals, rocks and earth history. Upon the basis of this an appreciation of the origin of the present land forms can be very much better gained.

LABORATORY AND FIELD STUDY.

There are two aspects of the object of teaching ever to be kept in mind in this discussion. One is that actual information is to be imparted, the other that from the study the pupils are to gain a discipline of mind which the several branches of the subject are well calculated to give. From books the teacher may easily obtain the information needed for the instruction; the knowledge of how to impart the training is much more difficult to gain. It will seldom come without a direct interest in the subject, and this must be followed by some training and intelligent thought, preferably, though not necessarily, in some school where these subjects are taught. There are now opportunities for the study of geology and physical geography in the summer schools of some colleges, and these perhaps offer the best facilities for obtaining this training. Still, with interest in the subject, and sufficiently intelligent work, it is possible for a teacher, without great difficulty, to obtain sufficient training to enliven the teaching and to develop methods which shall arouse the interest of the students, and at the same time give them valuable mental discipline. I would urge that one of the things most fundamentally important, and one upon which the success of the whole work depends, is this very point of arousing the interest of the student. How to do this, no one can say. It rests with the individual teacher; but few subjects offer a better opportunity for the development of this power than does physical geography; and certainly one of the necessary conditions is a direct and even enthusiastic interest on the part of the teacher.

For suggestions as to method, I can make none better than to urge a careful study of the report of the conference on geography, which is contained in the report of the Committee of Ten. In this there are invaluable suggestions made by masters of the

subject, and no wide-awake teacher can peruse the report without finding in it stores of ideas of the utmost value. As an outcome of this report a pamphlet has been issued by Professors Davis, King and Collie,[1] containing suggestions concerning the use of topographic maps in physiographic study. This is also a storehouse of suggestions; but I would warn the teacher against a grave danger which may arise from the use of topographic maps. It is this: that first of all the pupil should really understand a topographic map. Without a thorough knowledge of the meaning of these, the interest is lost and with it the value of the training; for unless the real meaning of the map is plain to the student, its lesson is not half learned. Even with college students, I find it to be one of the gravest difficulties in the way of laboratory study in physiography. To a mind not trained even in a knowledge of the land surface, one which, as I have found in some college students, has no real conception of what a plateau or mountain is, the study of a contour map of the land may become one of the blindest searches after hidden truths. I am not at all certain that this difficulty can be overcome in the secondary school; but I am certain that it will prove to be a real difficulty.[2]

If done in the proper way, instruction with the aid of topographic maps may become of great value. In a properly selected series, such as that suggested in the pamphlet by Davis, King and Collie, the students will find lessons innumerable, and the teacher will be able to use them to develop habits of thought on the part of the pupil. The valleys are cañons; they have rounded sides; or the two classes may be seen on the same sheet. A plain is crossed by many streams or by few. The streams cross the mountains or run parallel to them. On one sheet there are numerous lakes and swamps, on another none, etc. Why are these conditions so? Under what conditions

[1] Report on Governmental Maps for use in Schools, Henry Holt & Co., New York 1894.

[2] In this short article I cannot fully refer to the sources of topographic maps; and fortunately this is not necessary, since any one interested can obtain the information from the pamphlet by Davis, King & Collie, referred to above.

would they be different? Show a map in which they are really different and have it carefully studied. If he will, the teacher can make this use of the maps of great value, regretting only that time does not allow a more extended use of them.

Better than the topographic map is the model, but unfortunately there are few of these that are available, and most that are can be purchased only at great expense. Still this difficulty is almost certain to be remedied soon. There are two models which should be in every school that can afford them. One of these is the Jones model of the earth, sold (for $100 with discount) by Thomas Jones, Chicago, Ill., which is really a globe showing the relief of the land and the ocean bottom without the presence of the ocean waters. The other is the Howell relief model of the United States, sold by E. E. Howell, 612 Seventeenth st., N. W., Washington, D. C. There are two sizes of this, the largest costing $125, the smaller $25. From these one may learn much concerning the general features of the earth's surface, which are shown in relief. Relief maps, such as the Kiepert, which are sold by Rand, McNally & Co., and other dealers in school supplies, are also valuable for a study of the general features of the land.[1]

Still, while I believe that in many cases the map and the model can be made a valuable aid in the instruction, I would place more stress upon the use of photographs. The majority of the features of the land can be illustrated by these. Series carefully selected to show different kinds and stages of topography can be studied by the pupils individually. Or, better than this, each student may be supplied with a blue print, which may be obtained, in large numbers, at a very slight cost. But wherever possible the lantern slide should be used in place of the photograph.[2]

[1] Lists of these with prices may be obtained from dealers.

[2] A series of lantern slides for this purpose has been selected by Professor Davis and described by him in a pamphlet, entitled, "List of Geographical Lantern Slides," published as one of the papers of the physical geography laboratory of Harvard University. The slides, which are over one hundred in number, are sold by E. E. Howell, 612 Seventeenth st., N. W., Washington, D. C., at the uniform price of 50 cents each.

It is possible to use an electric lantern in a partially darkened room, and this is far preferable to the use of the old-fashioned oxo-hydrogen lantern. Fortunately, at present, the use of electricity is possible in many schools.[1]

With the picture on the screen, the methods of field work may very easily be introduced. Every pupil can see the features illustrated, and in place of a recitation, the teacher can do much in the way of valuable instruction by calling for a description and starting a discussion of the feature illustrated by the picture, and upon other related subjects upon which it throws light.

Of course the very best way to study the form of the land is to see the real thing; but, unfortunately, no single place is so favorably situated as to have near at hand even the majority of the features of the land. The seacoast, the mountain, the volcano, and many other features would be impossible of study in most schools. For the purpose of obtaining knowledge of these, models, maps and photographs must be substituted. However, since one of the prime objects of the study is the training, it matters little whether the students are unable to see all the features of the land or not. Field study is well calculated to train habits of observation and logical reasoning; and, therefore, even a few excursions, for the purpose of studying some of the features of land, will be found to be of the greatest value, provided the work is properly done. No general rules can be laid down. Each teacher must seek out lessons by himself and apply them in the best way that he can.

One of the most important features of the field study is that the student is taught to see for himself. It is possible to conduct field excursions in either one of three ways, only one of which produces a really valuable result. The excursion may be made an outing, in the course of which, the teacher tells the

[1] The electric lantern will cost from $125 to $200; but the oxo-hydrogen lantern costs considerable less. In order not to injure the eyes of the students, the screen should not be placed directly in front of the class, but to one side; and the lantern may then be managed by the teacher in front of the class and on the side of the room opposite the curtain.

pupils what he himself is able to see, thus adding a little more to the store of information with which the student mind is constantly being crammed; or the pupils may be placed entirely upon their own mental resources, and be set at work to make their own observations and draw from them conclusions which they must defend against criticism. This may at first seem to be the really valuable method; but having seen both of the above plans tried, I am convinced that the mere outing produces more good than the second method. Even people of mature minds are appalled when they are set to work in an entirely new field and obliged to think for themselves. The mind is incapable of the task, and the study, instead of being a pleasure, and one filled with interest, soon becomes not only unattractive but even distasteful.

Instead of being placed on his own resources, the student should be skillfully led by the teacher into the habit of seeing and of building up conclusions from what he sees. We will take but one or two illustrations of field study, which will be found possible in nearly every district in the country. We may first imagine the class assembled at the foot of a ledge of rock. They are told to examine this and report. One of the members is asked what he has seen. Perhaps he has only discovered the existence of the ledge, for this is all that most people would see. Other members of the class are asked the same question, and one is found who has discovered that the rock is made of layers, one jutting out beyond another. Every student should then see this fact and the class might well be told to examine the ledge again and see if they can find any differences in the layers which will explain the projecting and reëntrant parts of the ledge. What relation do these differences bear to the irregularities of the surface? and is it constant?

After this it is found that there are joint planes crossing the rock, and perhaps fossils can be found in some of the layers, while plants are at work disintegrating the ledge. Indeed, in this single outcrop may be found the entire lesson of weathering, or if not all the details, at least enough of them to make intelli-

gible a statement or study of the other phenomena of rock destruction. From this ledge, not only do we see how rocks crumble, but we learn the first lesson in the formation of soils, many facts concerning the structures of the rocks, and even obtain the basis for a proper understanding of how the land surface melts down and assumes variable outlines throughout the ages. Many excursions could be made and each one furnish its lessons of value. Indeed, from this as a basis, a skillful teacher could build up a good part of geology and physiography.

For a second illustration of possible methods of teaching field work, we may suppose that the class is led to the bank of a river or creek. It is now flowing quietly. Is this the constant condition? There has been no rain for days or perhaps for weeks; then where does the water come from? A spring near at hand tells the story, and from this may be gleaned the lesson of the work of underground water; its action in the solution and decay of minerals, formation of caverns, landslides, etc.

Returning to the stream, its bed is found to be lined with pebbles or possibly boulders. What are their features? They are smooth, partially rounded, though somewhat flattened and laid with their flat sides in a position to offer the least resistance to the flow of water. Are they all of one kind? What is their source? How did they get where they are? What will become of them? Have the students seen the stream when it was a roaring flood? These and other questions lead up to the conclusion that the running water is deepening the channel and moving the fragments down stream. What will be the result after long periods of time? How will the action of underground water and weathering influence the work of the river? Have any of the class seen the muddy rills in the road or in a field during a heavy rain?

Here we have the basis for the study of river valleys from which the class can see how under some conditions a narrow valley is produced, while under others, a valley is broad with gently sloping sides. The effects of differences in enclosing rocks, of the absence of some of the agents of weathering, as in arid lands,

of moderate and uniform flow, of steep and gently sloping banks, etc., can be deduced from facts seen in the field or suggested by field observations. Here again a skillful and well-trained teacher could, if he would, take up from this tiny stream, which is perhaps no more than a brook, the whole question of the sculpturing of the land, the history of the development of the river valley, and the reasons for the many differences in river valleys.

The waterfall, the sand bar in the river, the glacial deposits, the lake or seashore; all of these, and others, which are seemingly things merely to be described, are really phenomena to be studied for the direct lessons which they teach and also for the light which they throw upon other phenomena. No one can give general printed directions to the teacher which shall serve to tell him how this and that can be done. He must, first of all, become familiar with the country around his school; and he must put himself into the position of the student and see what lessons he can find, then thoughtfully reflect upon the way in which he can apply these lessons. Working in this spirit, any teacher of intelligence can prepare himself to use the outdoor lessons for the benefit of his class. Naturally, some will do it better than others; but anyone who will try, will find that he can put a real, live interest into the students by relieving them of the monotony of learning from a book, and by showing them how they can learn from nature's great book.

I anticipate the criticism that this calls for time that is not available. Little could be done in an hour, for often this time would be required in coming and going. This is a real and serious objection, but I do not think it fatal. I have known teachers who have organized voluntary excursions at times other than those of the regular school periods, and I think that this would never be impossible. Again, I have known teachers who have given students instructions to visit a certain locality at some leisure time and to report upon it. The reports were discussed in the class and then the members were asked to go again for additional facts. In making such excursions, they would go in

squads or parties when they had the time, and the particular class which I had in mind was full of enthusiasm, an enthusiasm derived partly from an interest in the work and partly obtained from the teacher who had so much of it that it became contagious. This method, though better than no field work, is certainly inferior to that in which the teacher is actually present as director and guide.

Each student can do field work on his way to and from the school, provided his home lies beyond the region of paved streets; and sometimes this is possible even in the midst of a large city. Reporting on what he sees, he can obtain the training and learn some of the lessons of the earth's surface. Students are always glad of a chance to work and think for themselves; it is not only a relief and change, but it appeals to the pride of one who is anxious to do his best, provided always that he has the interest.

In these suggestions, I have not felt it necessary to follow any especial order, because it is not my purpose to tell just how the study should be carried on, and the same method would hardly apply in two different schools. The best that I hope to do is to throw out a few hints which shall serve to suggest others to the teacher who is interested. Nor have I attempted to distinguish between the study of the land from the standpoint of geology and physiography; for, as I have indicated above, it is my belief that they go hand in hand and cannot properly be separated.

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(To be concluded)